Small Business Innovation Research/Small Business Tech Transfer

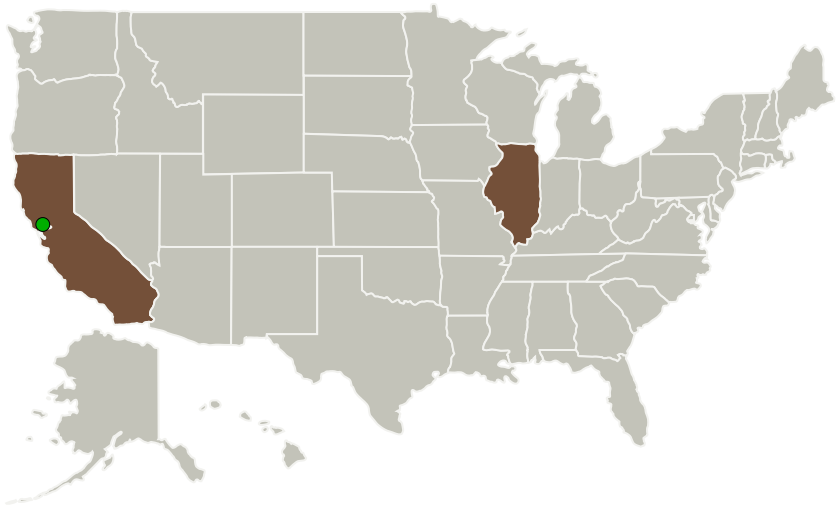
High Power Betavoltaic Technology, Phase I

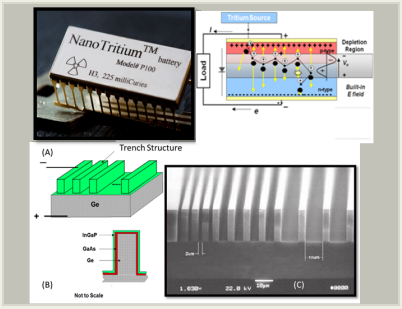
Completed Technology Project (2014 - 2014)

Project Introduction

The proposed innovation will dramatically improve the performance of tritium-powered betavoltaic batteries through the development of a high-aspect ratio, expanded surface area p/n junction composed of indium gallium phosphide. The enhanced surface area features will be built using reactive ion etch (RIE) modified germanium substrates via metalorganic chemical vapor deposition (MOCVD). The proposed 3-dimensional betavoltaic p/n junction will provide a cost saving of up to 90%, while increasing energy density to up to ten times that of lithium batteries. Such an advanced semiconductor device will produce much higher power outputs than are possible with existing state-of-the-art devices. It will provide the battery a life span in excess of 20 years with the broad-range temperature-insensitivity benefits normally associated with betavoltaics. This increased power/energy density for tritium betavoltaics will open up pathways for significant advances in power solutions for diminutive sized, low-power microelectronic devices that may be used in Cubesat and in-space power systems. Example applications include microwatt-to-milliwatt autonomous 20+ year sensors/microelectronics for use in structural monitoring, mesh networks, tagging and tracking wireless sensors, medical device implants, and deep space power where solar is not easily available. Tritium betavoltaics are capable of addressing this power niche for devices requiring reliable, uninterrupted power through extremes of temperature, longevity and diminutive form factors where traditional batteries cannot operate.

Primary U.S. Work Locations and Key Partners





High Power Betavoltaic Technology Project Image

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Organizations Performing Work	Role	Type	Location
MicroLink Devices, Inc.	Lead Organization	Industry Minority-Owned Business	Niles, Illinois
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Illinois

Project Transitions

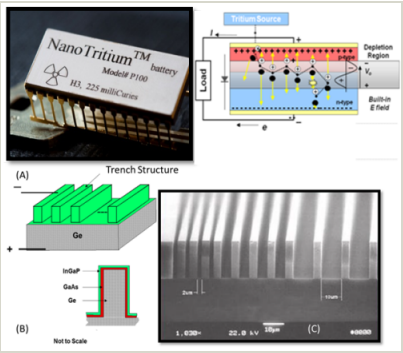
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137420)*

Images



Project Image
High Power Betavoltaic Technology Project Image
(https://techport.nasa.gov/image/126042)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

MicroLink Devices, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

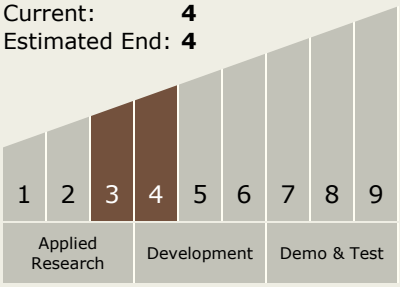
Carlos Torrez

Principal Investigator:

Glen Hillier

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.2 Heat Sources

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System